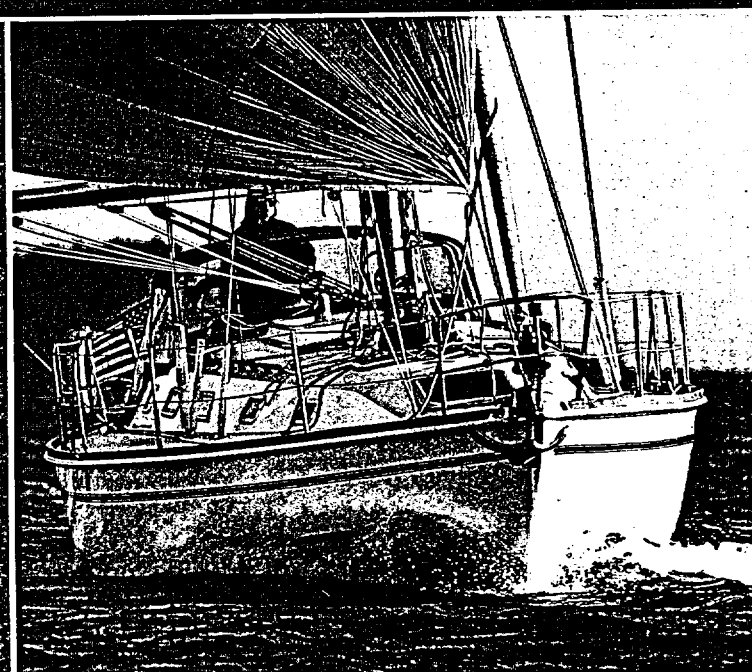
THE BOATING WORLD'S
MOST RESPECTED REFERENCE

CHAPMAN
PILOTING

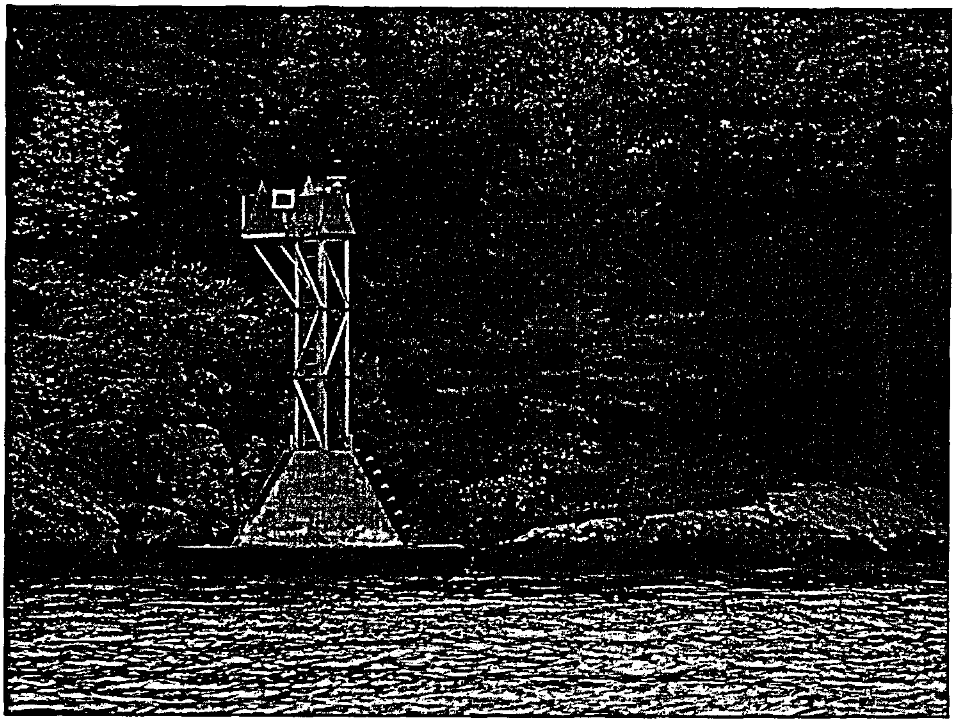
Seamanship & Small Boat Handling



THE INDISPENSABLE BOATING REFERENCE RECOMMENDED BY THE U.S. POWER SQUADRONS AND THE U.S. COAST GUARD AUXILIARY
WITH NEW PHOTOGRAPHS, CHARTS, AND ILLUSTRATIONS

Elbert S. Maloney

62nd EDITION



Minor lights may also be equipped with daymarks like these red triangular shapes which correspond to nun buoys. Green squares correspond to can buoys. The color of the light matches that of the daymark.

The period of a light is the time it takes to complete one full cycle of flash and dark interval, or flashes and dark intervals. A light described as "Flashing 4 seconds" has a period of 4 seconds. One flash and one dark interval lasts just that long before the cycle is repeated. Three standard periods are used—flashing at intervals of 2.5, 4 and 6 seconds.

The term "characteristics" as applied to a lighted aid to navigation includes the color as well as the rhythm, and may also cover physical features such as nominal range.

Cautions in using buoys

Do not count on floating aids always maintaining their precise charted positions, or unerringly displaying their characteristics. Although the Coast Guard works constantly to keep aids on station and functioning properly, obstacles to perfect performance are so great that complete reliability is impossible. In any case, it is important to remember that a buoy does not maintain its position directly over its sinker, as it must have some scope on its anchor chain.

Buoys are heavily anchored, but may shift, be carried away, or sunk by storms or ships. Heavy storms may also cause shoals to shift relative to their buoys.

Under the influences of current and wind, a buoy swings in small circles around the sinker, which is the charted location. (Refer to Chapter 18 for information on chart symbols.) Swinging is unpredictable, and a boat attempting to pass too close risks collision with a yawing buoy. In extremely strong current a buoy may be pulled beneath the water surface.

Lighted buoys may malfunction and show no light, or show improper light characteristics. Audible signals on buoys are operated by action of the sea, and may be silent in calm water or may fail to sound because of a broken mechanism.

Buoys may also be temporarily removed for dredging operations, and in northern waters they may be discontinued for the winter or changed to prevent damage or loss from ice floes. The *Light List* volumes show dates for changes or for seasonal buoys, but these are only approximate and may be changed by weather or other conditions.

Temporary or permanent changes in buoys may be made between editions of charts. Keep informed of existing conditions through reading *Notices to Mariners* or *Local Notices to Mariners—(Appendices)*.

All buoys, especially those in exposed positions, should be regarded as warnings or guides, and not as infallible navigation marks. Whenever possible, navigate with bearings or angles on fixed aids or objects on shore as well as by soundings rather than by total reliance on buoys.

Daybeacons

Rather than floating like buoys, daybeacons are unlighted aids that are fixed structures. They may be either on shore or in waters up to about 15 feet deep.

Daybeacons vary greatly in design and construction, depending upon their location and the distance from which they must be seen. Daybeacons in United States waters, and their chart symbols, are illustrated later in this chapter.

The simplest daybeacon is a single pile with signboards, called dayboards (or sometimes called daymarks), at or near its top, usually two facing in opposite directions. The pile may be wood, concrete or metal.

Bowditch

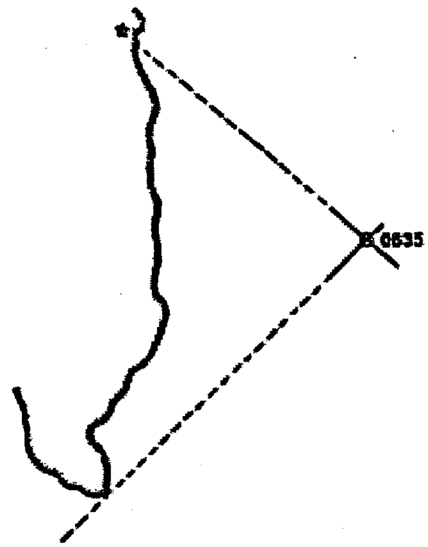


Figure 811a. A fix by two bearing lines.

bearings to a NAVAID and a bearing to the tangent of a body of land. See Figure 811a. The intersection of these lines constitutes a fix. Plotting bearing lines from charted buoys is the least preferred method of fixing by two bearing lines because the buoy's charted position is only approximate. Tangent LOPs to land areas must be taken carefully to get an accurate line, particularly at long ranges; charted NAVAIDS are preferred.

- **Fix by Two Ranges:** The navigator can plot a fix consisting of the intersection of two range arcs from charted objects. He can obtain an object's range in several ways:

1. **Radar Ranges:** See Figure 811b. The plotter lays down a range arc from a small island and a range arc from a prominent point on shore. The intersection of the range arcs constitutes a fix. The navigator can plot ranges from any point on the radar scope which he can correlate on his chart. This is the most convenient and accurate way to obtain an object's range. If a choice is available between fixed radar NAVAIDS and low lying land, choose the fixed NAVAID. This will minimize errors caused by using low lying land subject to large tidal ranges.

2. **Stadimeter Ranges:** Given a known height of a NAVAID, use a stadimeter to determine the range. Though most often used to determine the distance to a surface contact, a stadimeter can be used to determine an object's range. See Figure 811c for a representation of the geometry involved. Generally, stadimeters contain a height scale on which is set the height of the object. The observer then directs his line of sight through the stadimeter to the base of the object being observed. Finally, he adjusts the stadimeter's range index until the object's top reflection is "brought down" to the visible horizon. Read the object's range off of the stadimeter's range index.

3. **Sextant Vertical Angles:** Measure the vertical angle from the top of the NAVAID to the waterline below the NAVAID. Enter Table 16 to determine the distance of the NAVAID. The navigator must

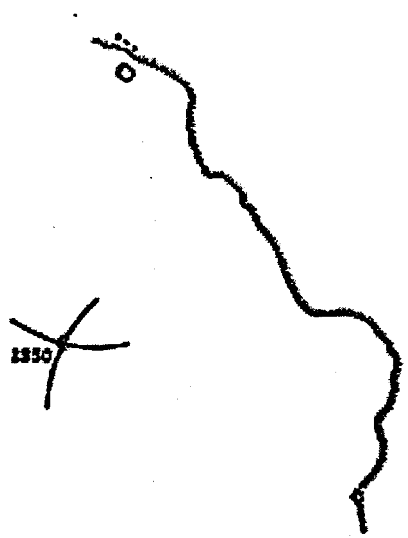


Figure 811b. A fix by two radar ranges.

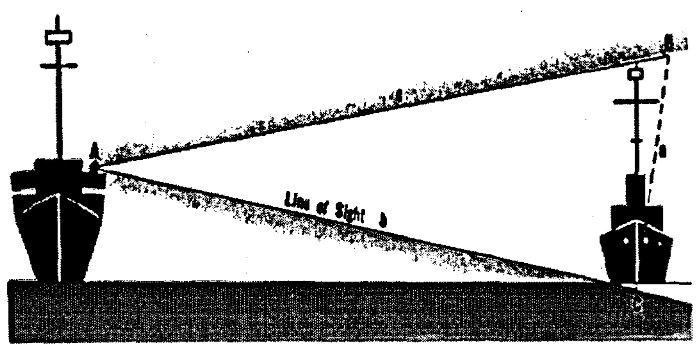


Figure 811c. Principle of stadimeter operation.

or cast iron **sinker**. See Figure 512. Because buoys are subjected to waves, wind, and tides, the moorings must be deployed with chain lengths much greater than the water depth. The scope of chain will normally be about 3 times the water depth. The length of the mooring chain defines a **watch circle** within which the buoy can be expected to swing. It is for this reason that the charted buoy symbol has a "position approximate" circle to indicate its charted position, whereas a light position is shown by a dot at the exact location. Actual watch circles do not necessarily coincide with the "position approximate" circles which represent them.

Over several years, the chain gradually wears out and must be replaced with new. The worn chain is often cast into the concrete of new sinkers.

513. Large Navigational Buoys

Large navigational buoys are moored in open water at approaches to major seacoast ports. These 40-foot diameter buoys (Figure 513) show lights from heights of about 36 feet above the water. Emergency lights automatically energize if the main light is extinguished. These buoys may also have a radiobeacon and sound signals. Their condition is monitored by radio from shore.

514. Wreck Buoys

A **wreck buoy** usually cannot be placed directly over the wreck it is intended to mark because the buoy tender may not want to pass over a shallow wreck or risk fouling the buoy mooring. For this reason, a wreck buoy is usually placed as closely as possible on the seaward or channelward side of a wreck. In some situations, two buoys may be used to mark the wreck, one lying off each end. The wreck may lie directly between them or inshore of a line between them, depending on the local situation. The *Local Notice To Mariners* should be consulted concerning details of the placement of wreck buoys on individual wrecks. Often it will also give particulars of the wreck and what activities may be in progress to clear it.

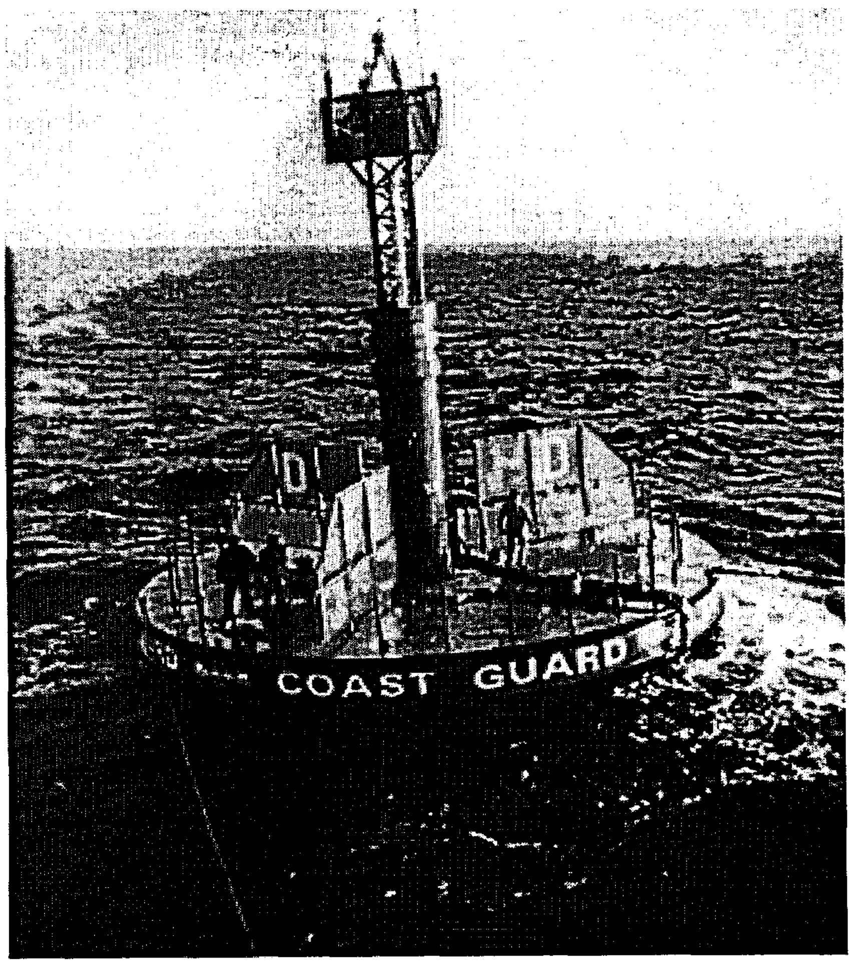


Figure 513. Large navigational buoy.

The charted position of a wreck buoy will usually be offset from the actual geographic position so that the wreck and buoy symbols do not coincide. Only on the largest scale chart will the actual and charted positions of both wreck and buoy be the same. Where they might overlap, it is the wreck symbol which occupies the exact charted position and the buoy symbol which is offset.

Wreck buoys are required to be placed by the owner of the wreck, but they may be placed by the Coast Guard if the owner is unable to comply with this requirement. In general, privately placed aids are not as reliable as Coast Guard aids.

Sunken wrecks are sometimes moved away from their buoys by storms, currents, freshets, or other causes. Just as shoals may shift away from the buoys placed to mark them, wrecks may shift away from wreck buoys.

515. Fallibility Of Buoys

Buoys cannot be relied on to maintain their charted positions consistently. They are subject to a variety of hazards including severe weather, collision, mooring casualties, and electrical failure. Report any discrepancy noted in a buoy to the U.S. Coast Guard.

The buoy symbol shown on charts indicates the approximate position of the sinker which secures the buoy to the seabed. The approximate position is used because of practical limitations in placing and keeping buoys and their sinkers in precise geographical locations. These limitations include prevailing atmospheric and sea conditions, the slope and type of material making up the seabed, the scope of the mooring chain, and the fact that the positions of the buoys and the sinkers are not under continuous surveillance. The position of the buoy shifts around the area shown by the chart symbol due to the forces of wind and current.

A buoy may not be in its charted position because of changes in the feature it marks. For example, a buoy meant to mark a shoal whose boundaries are shifting might frequently be moved to mark the shoal accurately. A *Local Notice To Mariners* will report the change, and a *Notice To Mariners* chart correction may also be written. In some small channels which change often, buoys are not charted even when considered permanent; local knowledge is advised in such areas.

For these reasons, a mariner must not rely completely upon the position or operation of buoys, but should navigate using bearings of charted features, structures, and aids to navigation on shore. Further, a vessel attempting to pass too close aboard a buoy risks a collision with the buoy or the obstruction it marks.

BUOYAGE SYSTEMS

516. Lateral And Cardinal Systems

There are two major types of buoyage systems: the **lateral system** and the **cardinal system**. The lateral system is best suited for well-defined channels. The description of each buoy indicates the direction of danger relative to the course which is normally followed. In principle, the positions of marks in the lateral system are determined by the **general direction** taken by the mariner when approaching port from seaward. These positions may also be determined with reference to the main stream of flood current. The United States Aids to Navigation System is a lateral system.

The cardinal system is best suited for coasts with numerous isolated rocks, shoals, and islands, and for dangers in the open sea. The characteristic of each buoy indicates the approximate true bearing of the danger it marks. Thus, an eastern quadrant buoy marks a danger which lies to the west of the buoy. The following pages diagram the cardinal and lateral buoyage systems as found outside the United States.

517. The IALA Maritime Buoyage System

Although most of the major maritime nations have used either the lateral or the cardinal system for many years, details such as the buoy shapes and colors have varied from country to country. With the increase in maritime commerce between countries, the need for a uniform system of buoyage became apparent.

In 1889, an International Marine Conference held in Washington, D.C., recommended that in the lateral system, starboard hand buoys be painted red and port hand buoys black. Unfortunately, when lights for buoys were introduced some years later, some European countries placed red lights on the black port hand buoys to conform with the red lights marking the port side of harbor entrances, while in North America red lights were placed on red starboard hand buoys. In 1936, a League of Nations subcommittee recommended a coloring system opposite to the 1889 proposal.

The **International Association of Lighthouse Authorities (IALA)** is a non-governmental organization which consists of representatives of the worldwide community of aids to navigation services to promote information exchange and recommend improvements based on new technologies. In 1980, with the assistance of IMO and the IHO, the lighthouse authorities from 50 countries and representatives of 9 international organizations concerned with aids to navigation met and adopted the **IALA Maritime Buoyage System**. They established two regions, **Region A** and **Region B**, for the entire world. Region A roughly corresponds to the 1936 League of Nations system, and Region B to the older 1889 system.

Lateral marks differ between Regions A and B. Lateral marks in Region A use red and green colors by day and night